

Pad-Mounted Dry-Vault and Submersible
Automatic Circuit Recloser's and Fault
Interrupters for AC Systems

ANSI C37.72

(1987) Manually-Operated, Dead-Front
Pad-Mounted Switch Gear with Load
Interrupting Switches and Separable
Connections for Alternating-Current Systems

ANSI C57.12.28

(1999) Pad-Mounted Equipment - Enclosure
Integrity

ASTM INTERNATIONAL (ASTM)

ASTM D 2472

(1992) Sulphur Hexafluoride

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 386

(1995;R 2001) Standard for Separable
Insulated Connector Systems for Power
Distribution Systems Above 600V

1.2 GENERAL REQUIREMENTS

This specification governs the general requirements for manually operated load interrupting SF6 insulated switches which also contain vacuum interrupters.

1.3 SUBMITTALS

NOTE: Review submittal description (SD) definitions in Section .01 33 00 SUBMITTALS and edit the following list to reflect only the submittals required for the project. Submittals should be kept to the minimum required for adequate quality control. Include a columnar list of appropriate products and tests beneath each submittal description.

A "G" following a submittal item indicates that the submittal requires Government approval. Some submittals are already marked with a "G". Only delete an existing "G" if the submittal item is not complex and can be reviewed through the Contractor's Quality Control system. Only add a "G" if the submittal is sufficiently important or complex in context of the project.

For submittals requiring Government approval on Army projects, a code of up to three characters within the submittal tags may be used following the "G" designation to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes

following the "G" typically are not used for Navy, Air Force, and NASA projects.

Submittal items not designated with a "G" are considered as being for information only for Army projects and for Contractor Quality Control approval for Navy, Air Force, and NASA projects.

The following submittals shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES in sufficient detail to show full compliance with the specification:

SD-02 Shop Drawings

- a. Nameplate Diagram
- b. Single-Line Diagram for Switch
- c. Connection Diagram for Overcurrent Protection Including CT/PT Wiring, Auxiliary Power Supplies, if any
- d. Outline Drawing, Showing Plan and Elevation Views, with Complete dimensions
- e. Time-current Coordination Curves for all Available Trip Settings, Plotted on Standard Log-Log Coordination Paper

SD-03 Product Data

Equipment and Performance Data shall be provided for the following items:

- a. SF6 Load-Break Switches
- b. SF6 Switch Accessories
- c. Vacuum Interrupters
- d. Electronic Trip Units
- e. Pad-Mounted Enclosures, Including Material Composition
- f. Paint Coating System - Material and Application Description

SD-06 Test Reports

Design and Production Test Reports shall be submitted and shall be in accordance with ANSI C37.60 and ANSI C37.72.

PART 2 PRODUCTS

2.1 SWITCHES

Gas insulated load-break switches shall be of the pad-mounted type and shall be in accordance with applicable provisions of ANSI C37.72 and tamperproof in accordance with ANSI C57.12.28 Cable entrances shall be by means of separable connectors in accordance with IEEE 386.

Sulphur Hexafluoride (SF6) gas shall be in accordance with ASTM D 2472.

SF6 load-break switches shall be manually operated, load-interrupting type, load-break switches and shall have the following minimum ratings: 15 kV, 600 amperes continuous and load-break current rating for operation on a 13.2/13.8 kV, 3-phase, 4-wire, grounded wye system. Switches shall be the type indicated and shall be designed to show the internal wiring, indicating each switch position. Each "switched" way shall be provided with 600A equipment apparatus bushings. Each "interrupter" way shall be provided

with 200A deepwell equipment bushings and 200A loadbreak inserts unless otherwise indicated.

Switched ways shall be provided with a visible break feature that allows direct viewing of the switch contacts in their various positions within the switch tank.

Operating handles shall come equipped with handles for manual operation and shall be operated by a non-teasible, snap-action, quick-make, quick-break mechanism. Opening and closing of the main contacts shall be totally independent of the speed or position of the operating handle. Operating handle shall be secured to the shaft in a manner that will ensure tightness and alignment. Provisions for padlocking operating handle for each way in any position shall be provided.

Switch enclosures shall be in accordance with ANSI C57.12.28 and shall be equipped with a ground bus capable of carrying the rated fault current for one second for each way. Enclosures shall be sized such that the center-line of the apparatus bushing shall be a minimum of 36 inches above base of enclosure. Further, there shall be a minimum depth of 24 inches for the interior of the cabinet housing cable terminations. Rear cable entrances are preferred but not mandatory.

Fittings, lifting eyes, insulators, and other required operational features or tools should be provided with the switch as necessary.

All operating parts of switch assemblies shall be of corrosion-resistant metals suitable for installation in a coastal, high-humidity environment and compatible with stainless steel parts to avoid galvanic action due to dissimilar metals.

2.1.1 Switched Ways

Each switched way shall be capable of three positions - "Closed", "Open", and "Ground", unless otherwise indicated. Provide number of switched ways as indicated.

Each switched way shall be manufactured in accordance with ANSI C37.72 and shall have the following minimum ratings:

Current Rating, Continuous and Load-Break	600 amps
Basic Impulse Insulation Level (BIL)	95 kV
1 Minute withstand, AC	34 kV
Momentary Current Rating, Asymmetrical	40 kA
Close Rating, 1 second Symmetrical	25 kA

2.1.2 Vacuum Interrupter Switched Ways

Provide vacuum interrupter ways as indicated.

Each vacuum interrupter way shall be manufactured in accordance with ANSI C37.60 and ANSI C37.72 and shall have the following minimum ratings:

Current Rating, Continuous and Load-Break	200 amps
Basic Impulse Insulation Level (BIL)	95 kV
1 Minute Withstand, AC	34 kV
Momentary Current Rating, Asymmetrical	19.2 kA
Close Rating, 1 second Symmetrical	12 kA
Interrupting Rating	12 kA

The vacuum interrupter shall consist of a vacuum bottle and spring-assisted operating mechanism. The operating mechanism shall be three-phase, gang-operated, and shall have a spring latch mechanism and solenoid for electronic tripping. The operating mechanism shall provide for "trip-free" operation, permitting the vacuum interrupter to trip independent of the operating lever position if closed into a faulted circuit. Maximum trip time shall be three cycles. The movable vacuum contacts shall have a means of visual indication of contact position. Vacuum bottle shall be completely enclosed in SF6 dielectric.

2.1.3 Electronic Trip Units

Electronic trip units shall be solid-state, powered from the current transformers used for sensing or by means of internal potential transformers (PTs) or via external D.C. battery power source. Use of cable fault indicators in lieu of electronic trip units is not acceptable.

Trip units shall be capable of being set for true RMS single-phase or three-phase with neutral sensing capabilities.. Trip units shall be capable of being set to provide protection curves including, but not limited to, standard "CO" type overcurrent relay curves and/or mimic the following fuse types: "E", "K", "KS", "QA", "EF", "T".

Trip settings shall be adjustable locally at the switch without requiring removal of the trip unit. The trip settings shall be clearly visible from the front panel of the trip unit. The units shall not rely on volatile electronic memory to retain their trip settings.

The following trip settings shall be provided:

- Long time
- Short time
- Instantaneous
- Ground Fault

Trip units shall provide visible trip indication by phase that shall remain after a trip event until the unit is manually reset.

Trip units shall be capable of operating satisfactorily in a coastal, humid climate with temperatures from minus 10 degrees C to 80 degrees C.

If trip unit is not a typical industry standard device (having standard bench testing capabilities), then two test kits shall be provided to provide for in-service functional testing of each trip function. The test kits shall be products of the trip unit manufacturer.

2.1.4 Nameplate

A nameplate of stainless steel shall be provided.

The nameplate shall be tack welded securely to the top of the tank by means of AISI 308 stainless steel filler.

All letters, schematics and numbers shall be photo engraved on the nameplate.

The nameplate shall contain at least the following information:

- a. The Word "Switch"
- b. Name of manufacturer
- c. Date of Manufacture (Month and Year, for example, 1-90)
- d. Serial Number
- e. Model Number or Style Number
- f. Rated Maximum Voltage
- g. Rated Impulse Withstand Voltage
- h. Rated Continuous Current
- i. Rated Load Interrupting Current
- j. Rated Fault Interrupting Current
- k. Rated Momentary Current
- l. Rated Making Current
- m. A Three-Line Bushing-Oriented Schematic Diagram, using Standard Symbols (This may be put on a Separate Nameplate)
- n. Total Weight (Including Insulating Medium)
- o. Type and Quantity of Insulating Medium

2.2 ACCESSORIES

Each switch shall have a pressure gage, an additional flange, welded to the switch tank, to accommodate future gas pressure switch, position viewing window, gas filling plug, and shall include provisions to enable operating any way of the switch from distance of no less than 25 feet from the switch. This remote operation feature may be achieved either through manual operation or remote electrical operation but must include ability to switch even if the 25-foot distance is not in a straight line and is around corners/bends.

Provisions for future addition (including necessary mounting brackets, if required) of motor operators to "switched" ways shall be provided separable connectors, with type/ratings as previously described, shall be provided for each way in accordance with [IEEE 386](#).

Current Transformers (CTs) required for vacuum interrupters shall be provided and wired to shorting-type terminal blocks external to the SF6 enclosure, but enclosed within the overall enclosure.

If auxiliary metering is indicated, three 200:5A CTs (one per phase) shall be supplied for each interrupter way having the following accuracy: C50 (relay accuracy) or 0.3% (metering accuracy) at B-0.2 metering burden. In addition, one set of potential transformers (PTs) (one per phase) shall be supplied with 0.3%, or equal, accuracy at W, X, or y burden. PTs shall be connected to main bus such that one set of PTs may support more than one meter. If the same instrument transformers are to be utilized for both protective (relaying) and metering, manufacturer is responsible to ensure that instrument transformers have sufficient burden capacity to properly operate the connected devices. The instrument transformers shall be located internal to the SF6 insulating medium.

Auxiliary contacts to indicate switch/interrupter position status (for future SCADA connection) shall be provided and wired to terminal blocks external to the SF6 enclosure, but enclosed within the overall enclosure.

2.3 MOUNTING FRAME TANK AND ENCLOSURE

The tank shall be constructed of all welded 304 Stainless Steel. The swinging doors shall being latched in the position.

All access door hinge pins and appurtenances shall be made of AISI 304

Stainless Steel to maintain corrosion resistance properties.

After fabrication, all exposed metal surfaces of the pad-mounted frame tank and enclosure shall be cleaned and painted in accordance with ANSI C37.72.

In addition, enclosure shall be painted with a coating system suitable for a Florida coastal/marine environment, as recommended in writing by a NACE certified coatings specialist.

Mounting frame, switch tank, and freestanding enclosure shall be manufactured of minimum grade 304L stainless steel and painted in accordance with ANSI C37.72.

2.4 WITNESS TESTING

Manufacturing production and testing schedules, including Design and Production Test Reports shall be furnished and coordinated so that Contractor's representative(s) may be present in the factory to witness either various stages of manufacturing or final acceptance testing at no additional cost.

PART 3 EXECUTION

3.1 TESTING REQUIREMENTS

3.1.1 Tank

The finished tank will be pressurized to 5 pounds per square inch and tested for leaks using suitable leak detection methodology.

3.1.2 Electrical

Thirty-four kV AC hipot for one minute phase-to-phase, phase-to-ground, and across open contacts on all ways.

Continuity test all circuits.

Production test shall be performed per ANSI C37.72.

3.2 SHIPPING REQUIREMENTS

3.2.1 Preparation

The switch shall be completely assembled and shall include the correct amount of insulating medium. Switches shall be properly packaged, labeled, and braced to prevent damage during shipment.

Label shall be visible with manufacturer part number.

Prior to shipment, the completed switch assembly shall be certified to have a gas leak rate of less than 10 to the minus 7 power cubic centimeters per second by a helium mass spectrometer test. Switches shall be sealed and filled with SF6 to a manufacturer's rated nominal pressure values that shall be specified on leak test reports.

3.2.2 Documentation

Instructions and checklists for the inspection, installation and maintenance of the switch shall be provided.

3.3 MANUFACTURER'S FIELD SERVICES

The Subcontractor shall furnish the services of one or more manufacturer's service representatives for the equipment and materials furnished under these specifications. The service representatives shall be technically competent factory trained; experienced in the installation and operation of the equipment; and authorized by the manufacturer to perform the work stipulated.

The service representatives shall provide such service and assistance as is required for the proper installation, testing, and operation of each item of equipment to include, but not be limited to:

- a. Service required to correct design and manufacturing errors.
- b. Service required to guarantee correct and proper installation of the equipment.
- c. Service required after installation and changes or adjustments required to assure proper operation.

-- End of Section --